

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

MATHEMATICS

0580/4, 0581/4

PAPER 4

OCTOBER/NOVEMBER SESSION 2001

2 hours 30 minutes

Additional materials:

Answer paper
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)
Tracing paper (optional)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all** questions.

Write your answers on the separate answer paper provided.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer. Marks will be given for working which shows that you know how to solve the problem even if you get the answer wrong.

If you use more than one sheet of paper, fasten the sheets together.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 130.

Electronic calculators should be used.

If the degree of accuracy is not specified in the question, and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

For π , use either your calculator value or 3.142.

This question paper consists of 8 printed pages.

- 1 In an election in Anyville, the Blue party got 40% of the votes.

The Orange party got 11 424 votes which was seven eighths of the Blue party vote.

Some people voted for other parties and some did not vote at all.

(a) Calculate

(i) how many people in Anyville voted for the Blue party, [2]

(ii) how many people in Anyville voted. [2]

(b) There were 42 320 people in Anyville.

Calculate the percentage of people in Anyville who did **not** vote. [2]

(c) There were 572 senators in the new National Assembly.

The numbers of senators in the Blue, Orange and other parties were in the ratio

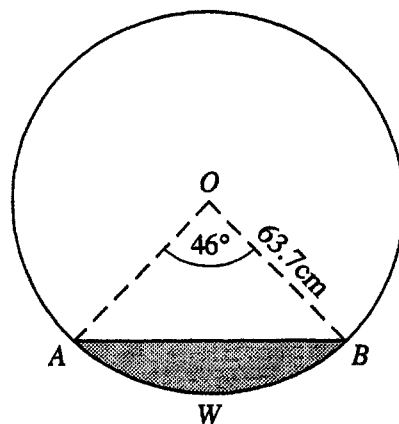
$$\text{Blue} : \text{Orange} : \text{Others} = 6 : 3 : 2.$$

Calculate

(i) the number of senators in the Orange party, [2]

(ii) the difference between the number of senators in the Blue party and the number who were **not** in the Blue party. [3]

2



NOT TO
SCALE

The diagram shows the circular cross-section of a horizontal pipe.

The shaded area shows water lying in the pipe.

The circle, centre O , has a radius 63.7 cm and angle $AOB = 46^\circ$.

(a) Calculate the arc length AWB . [3]

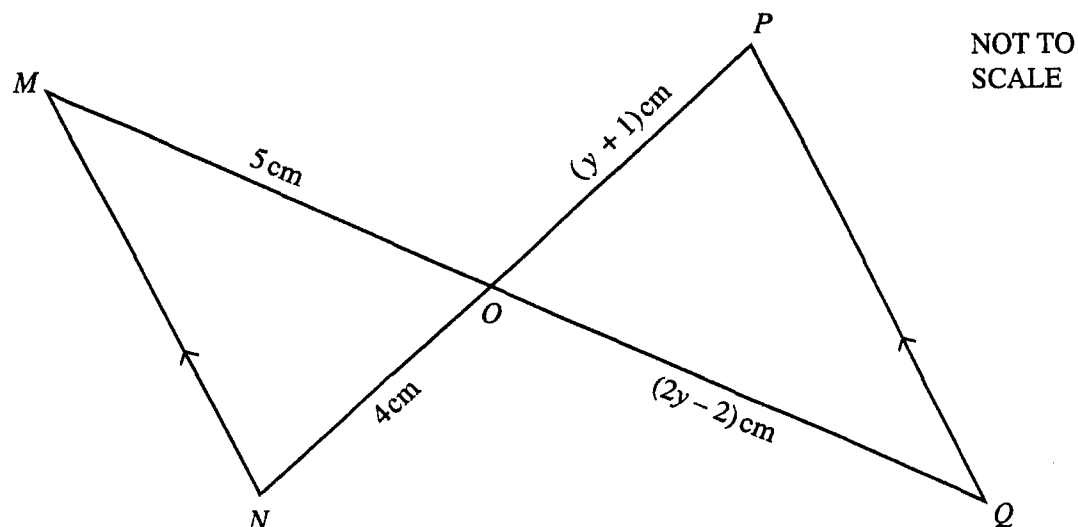
(b) Calculate the length of the straight line AB . [3]

(c) Calculate the length of the perpendicular from O to AB . [2]

(d) Write down the greatest depth of water in the pipe.

Give your answer correct to the nearest millimetre. [2]

3 (a)



In the diagram, MN and PQ are parallel and MQ and NP meet at O .

(i) Show that triangles MNO and QPO are similar. [2]

(ii) $OM = 5$ cm and $ON = 4$ cm. $OP = (y + 1)$ cm and $OQ = (2y - 2)$ cm.

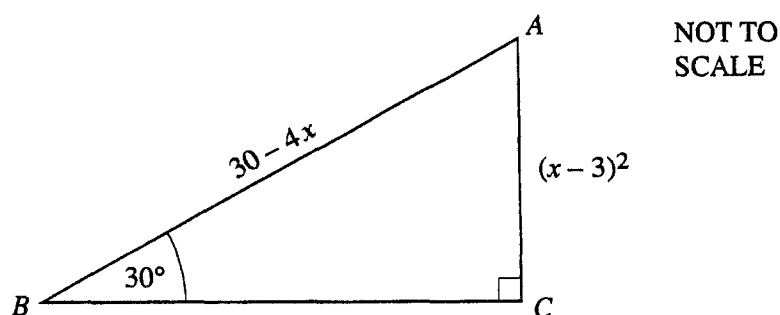
Explain why $\frac{2y - 2}{5} = \frac{y + 1}{4}$. [1]

(iii) Solve the equation in **part (a)(ii)**. [3]

(iv) Find the length of NP . [1]

(b) (i) Write down the value of $\sin 30^\circ$ as a fraction. [1]

(ii)



In triangle ABC , angle $ACB = 90^\circ$ and angle $ABC = 30^\circ$.

$AC = (x - 3)^2$ and $AB = (30 - 4x)$.

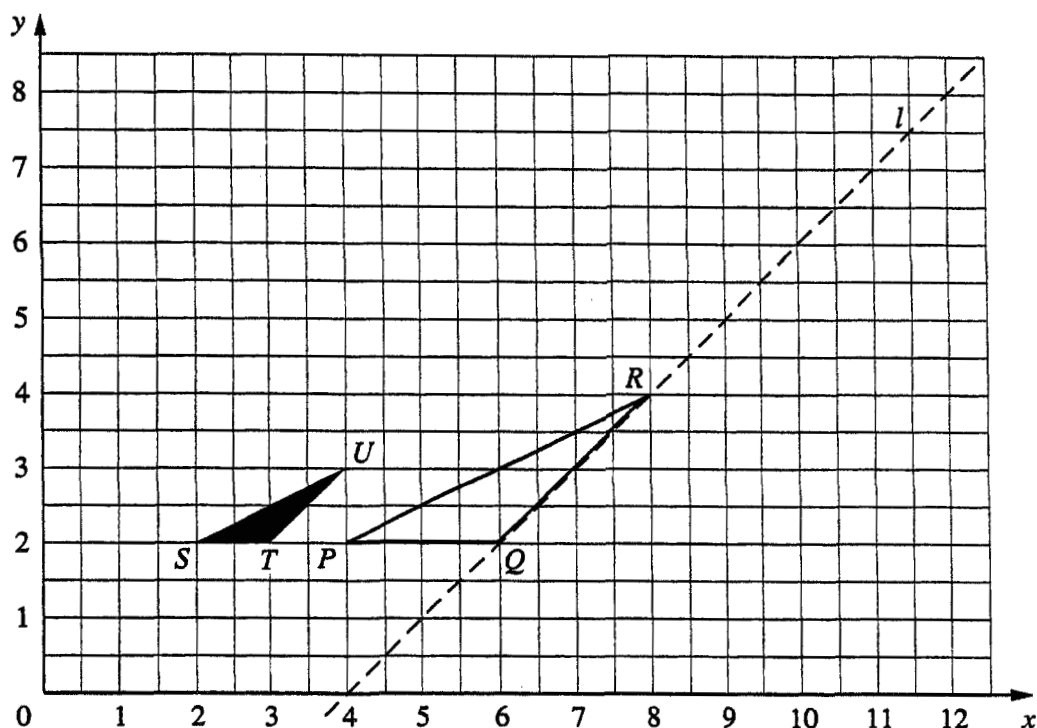
Use your answer to **part (b)(i)** to write down an equation in x .

Show that it simplifies to $x^2 - 4x - 6 = 0$. [3]

(iii) Solve the equation $x^2 - 4x - 6 = 0$.

Show all your working and give your answers correct to 2 decimal places. [4]

(iv) Find the length of AB when AC is greater than 10. [2]



You do not need to copy this diagram.

The coordinates of P , Q and R are $(4, 2)$, $(6, 2)$ and $(8, 4)$ respectively.

The points Q and R lie on the line l .

(a) Find the new coordinates for

(i) P , after reflection in the line l , [2]

(ii) Q , after translation by the vector $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$, [2]

(iii) R , after a rotation of 90° anticlockwise about centre P . [2]

(b) The coordinates of S , T and U are $(2, 2)$, $(3, 2)$ and $(4, 3)$ respectively.

(i) Describe fully the single transformation which maps triangle PQR onto the shaded triangle STU . [3]

(ii) Find, in the form $1 : n$, the ratio area of triangle STU : area of triangle PQR . [2]

(c) Find the new area of triangle PQR when it is stretched parallel to the y -axis with scale factor 3 and the x -axis invariant. [2]

(d) (i) Find the inverse of the matrix $\begin{pmatrix} 2 & 3 \\ -1 & 1 \end{pmatrix}$. [2]

(ii) A point W has coordinates (x, y) such that $\begin{pmatrix} 2 & 3 \\ -1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$.

Find the coordinates of W .

[3]

5 Answer the whole of this question on a sheet of graph paper.

- (a) 100 seeds were treated with fertilizer and the heights (H cm) of the plants which grew are given in the **cumulative** frequency table below.

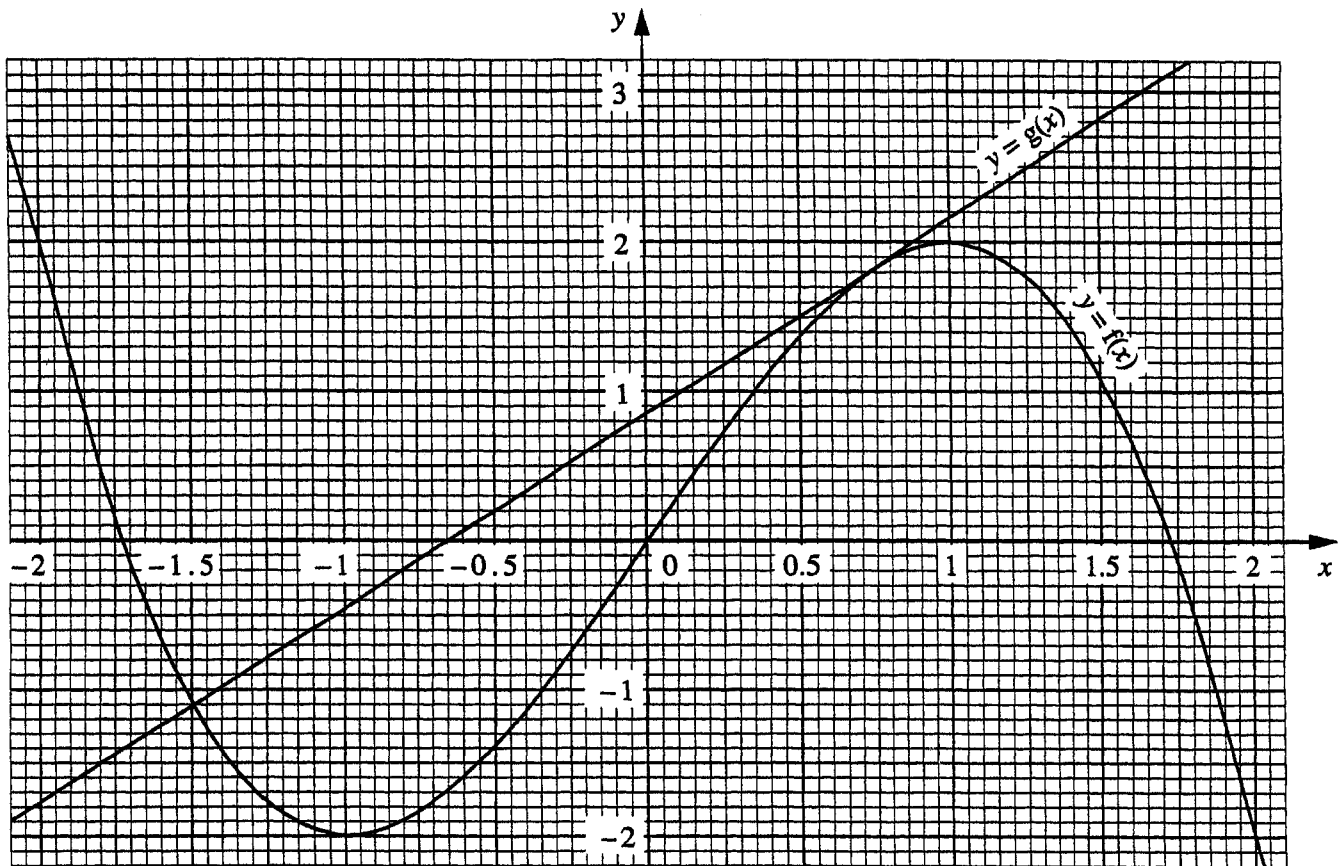
Height (H cm)	$H \leq 5$	$H \leq 10$	$H \leq 15$	$H \leq 20$	$H \leq 30$
Cumulative frequency	0	5	25	85	100

- (i) Using a scale of 2 cm to represent 5 cm on the horizontal H -axis and 2 cm to represent 20 plants on the vertical axis, draw a cumulative frequency diagram for these plants. [5]
- (ii) Find the median, the lower quartile and the interquartile range. [3]
- (iii) Write down the number of plants in the $15 < H \leq 20$ group. [1]
- (b) Another 100 seeds were **not** treated with fertilizer and the heights (h cm) of the plants which grew from these seeds are given in the grouped frequency table below.

Height (h cm)	$0 < h \leq 5$	$5 < h \leq 10$	$10 < h \leq 15$	$15 < h \leq 20$	$20 < h \leq 30$
Frequency	10	20	45	23	2

You do not need to draw another graph.

- (i) Calculate an estimate of the mean value of h . [4]
- (ii) Write down the class which contains the lower quartile. [1]
- (iii) Write down the class which contains the 90th percentile. [1]
- (c) The two groups of 100 plants are combined. One of these 200 plants is chosen at random.
- (i) Find the probability that its height is less than or equal to 10 cm. [2]
- (ii) Given that the plant height is less than or equal to 10 cm, what is the probability that it was treated with fertilizer? [2]



The graphs of $y = f(x)$ and $y = g(x)$ are drawn on the grid above.

The line $y = g(x)$ is the tangent to the curve $y = f(x)$ at $x = 0.75$.

(a) Find

(i) $f(1.5)$, [1]

(ii) $g(0)$, [1]

(iii) $g^{-1}(-0.5)$. [1]

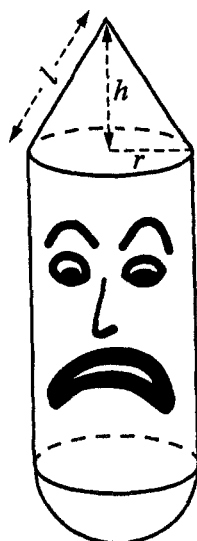
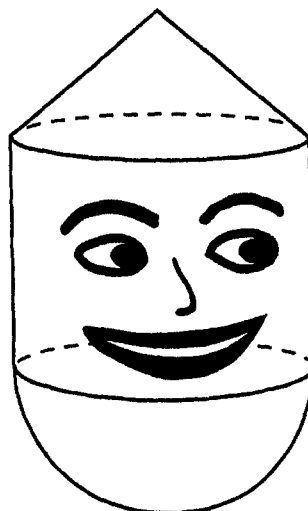
(b) (i) Find the range of values of x such that $f(x) > g(x)$. [2]

(ii) Solve $f(x) = 0$. [2]

(iii) Find the range of values for k when $f(x) = k$ has 3 different solutions. [2]

(c) Calculate the gradient of $y = f(x)$ where $x = 0.75$. [3]

(d) Solve $1 - f(x) = 0$. [3]

**GRUMPY GUY****HAPPY HAL**NOT TO
SCALE

Grumpy Guy and Happy Hal are children's toys. Each is made from a solid hemisphere, a cylinder and a cone.

[The volume of a sphere, radius r , is $\frac{4}{3}\pi r^3$ and the surface area of a sphere is $4\pi r^2$.

The volume of a cone, base radius r and perpendicular height h is $\frac{1}{3}\pi r^2 h$ and the surface area of a cone is $\pi r l$ where l is the slant height.]

- (a) Grumpy Guy has a radius of 3 cm. The height of his cylinder is 7 cm and the **perpendicular** height, h , of his cone is 4 cm.

Calculate for Guy

- (i) his volume, [4]

- (ii) his surface area. [5]

- (b) Happy Hal has a radius of x cm. The height of his cylinder is x cm and the **perpendicular** height of his cone is also x cm.

Find for Hal

- (i) his volume in terms of π and x , [3]

- (ii) his volume when $x = 5$. [1]

- (c) Happy Hal is made from two materials. The hemisphere is made from a heavy material and the rest from a lighter material.

The **mass** of the hemisphere is half the mass of the whole toy.

Find, in its simplest form, the ratio

mass of hemisphere : mass of cylinder : mass of cone. [3]

8 Answer the whole of this question on a sheet of graph paper.

There are x girls and y boys in a school choir.

- (a) (i) The number of girls is more than 1.5 times the number of boys in the choir.

Show that $y < \frac{2x}{3}$. [1]

- (ii) There are more than 12 girls in the choir.

There are more than 5 boys in the choir.

The maximum number of children in the choir is 35.

Write down three more inequalities. [3]

- (b) (i) Using a scale of 2 cm to represent 5 children on each axis, draw an x -axis for $0 \leq x \leq 40$ and a y -axis for $0 \leq y \leq 40$. [1]

- (ii) Draw 4 lines on your graph to represent the inequalities in part (a).

Shade the **unwanted** parts of the grid. [7]

- (c) The school buys a uniform for each choir member.

A girl's uniform costs \$25. A boy's uniform costs \$20.

Find the maximum possible cost for the choir uniforms. Mark clearly the point P on your graph which you use to calculate this cost. [3]

- 9 (a)** Write down the next two terms in the sequence

7, 10, 15, 22, [2]

- (b) Write down the next term and the 50th term in the sequence

$\frac{2}{5}, \frac{3}{7}, \frac{4}{9}, \frac{5}{11}, \dots$ [3]

- (c) Write down the next two terms and find an expression for the n th term in the sequence

17, 13, 9, 5, [4]